7 **van Tongeren M**, Gardiner K, Calvert I, *et al*. Efficiency of different grouping schemes for dust exposure in the European carbon black respiratory morbidity study. *Occup Environ Med* 1997;**54**:714–19.
8 **Vermeulen R**, de Hartog J, Swuste P, *et al*. Trends in exposure to inhalable particulate and dermal contamination in the rubber manufacturing industry: effectiveness of control measures implemented over a nine-year period. *Ann Occup Hyg* 2000;**44**: 343–54.
9 **Swuste P**, Kromhout H, Drown D. Prevention and control of chemical exposures in the rubber manufacturing industry in the Netherlands. *Ann Occup Hyg* 1993;**37**:117–34.
10 **Kromhout H**, Swuste P, Boleij JS. Empirical modelling of chemical exposure in the rubber-manufacturing industry. *Ann Occup Hyg* 1994;**38**:3–22.
11 **Peretz C**, Goren A, Smid T, *et al*. Application of mixed-effects models for exposure assessment. *Ann Occup Hyg* 2002;**46**:69–77.
12 **Kenny LC**, Aitken R, Chalmers C, *et al*. A collaborative European study of personal inhalable aerosol sampler performance. *Ann Occup Hyg* 1997;**41**:135–53.
13 **Burstyn I**, Kromhout H. Are the members of a paving crew uniformly exposed to bitumen fume, organic vapor, and benzo(a)pyrene? *Risk Anal* 2000;**20**:653–63.
14 **Rappaport SM**, Kromhout H, Symanski E. Variation of exposure between workers in homogeneous exposure groups. *Am Ind Hyg Assoc J* 1993;**54**:654–62.
15 **Vermeulen R**, Bos RP, de Hartog J, *et al*. Mutagenic profile of rubber dust and fume exposure in two rubber tire companies. *Mutat Res* 2000;**468**:165–71.
16 **Vermeulen R**, Bos RP, Kromhout H. Mutagenic exposure in the rubber manufacturing industry: an industry wide survey. *Mutat Res* 2001;**490**:27–34.
17 **Burstyn I**, Kromhout H, Cruise PJ, *et al*. Designing an international industrial hygiene database of exposures among workers in the asphalt industry. *Ann Occup Hyg* 2000;**44**:57–66.
18 **Burstyn I**, Kromhout H, Kauppinen T, *et al*. Statistical modelling of the determinants of historical exposure to bitumen and polycyclic aromatic hydrocarbons among paving workers. *Ann Occup Hyg* 2000;**44**:43–56.
19 **Kromhout H**, Vermeulen R. Long-term trends in occupational exposure: are they real? What causes them? What shall we do with them? *Ann Occup Hyg* 2000;**44**:325–7.


# ECHO

## Genes for antioxidant enzymes and PMF are not linked

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Susceptibility to progressive massive fibrosis (PMF) and polymorphisms in genes for antioxidant enzymes are not associated, according to the first case-control study to test this out. However, polymorphisms combined with environmental factors might still affect severity of the disease–a severe form of coal workers' pneumoconiosis.

Common single polymorphic variants of glutathione S-transferase (GST) and manganese superoxide dismutase (MnSOD)—GSTP1, GSTT1, and MnSOD—were not statistically associated with PMF in 350 ex-underground coal workers compared with control miners matched for age, years of mining exposure, and smoking but with no evidence of lung fibrosis or inflammation. Nor were there any significant gene-gene interactions, which would be expected for a multifactorial disease like PMF. Frequencies of the polymorphisms conformed to the Hardy-Weinberg equilibrium in both groups. The study was powerful enough to detect a relation between susceptibility and polymorphic genes at an odds ratio of 1.8.

Histologically confirmed cases of PMF were identified from a well defined group of miners taking part in the national coal workers autopsy study in the United States during 1972–96, from whom necroscopic lung samples had been collected. Genetic analysis relied on DNA extracted and amplified from these samples.

Genes for antioxidant GSTs and superoxide dismutases MnSOD, which combat the harmful effects of reactive oxygen species in the lungs and help to protect against interstitial lung disease, are very polymorphic. Several common variants of GSTs have been associated with cancers of various organs, including lungs, and chronic obstructive pulmonary disease.

▲ Yucesoy B, *et al*. *Thorax* 2005;**60**:492–495.